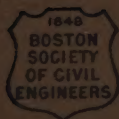


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PROCEEDINGS

PAPERS IN THIS NUMBER.

Commercial Aviation — the present State of the Art — with
Special Reference to the Development of Boston as an
Air Port.

“Development of the ‘Lighter-Than-Air’ Airship.” By
Edward Schildhauer.

“Commercial Use of Airplanes.” By Edward P. Warner.

“Boston Airport.” By R. C. Moffat.

Memoir of deceased member.

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APPLICATIONS FOR MEMBERSHIP.

[December 20, 1922.]

THE By-Laws provide that the Board of Government shall
consider applications for membership with reference to the
eligibility of each candidate for admission and shall determine
the proper grade of membership to which he is entitled.

The Board must depend largely upon the members of the
Society for the information which will enable it to arrive at a
just conclusion. Every member is therefore urged to communi-
cate promptly any facts in relation to the personal character or
professional reputation and experience of the candidates which
will assist the Board in its consideration. Communications

relating to applicants are considered by the Board as strictly confidential.

The fact that applicants give the names of certain members as reference does not necessarily mean that such members endorse the candidate.

The Board of Government will not consider applications until the expiration of twenty (20) days from the date given.

BATES, RUFUS EDWARD, Quincy, Mass. (Age 25, b. Weymouth, Mass.) He is a graduate of Wentworth Institute, 1917, and served in the 101st Engineers from May, 1917, to September same year. With the exception of one year (March, 1921–March, 1922) he has been engaged in construction work for himself, also employed by the Hood Rubber Co. Is now with the Aberthaw Construction Co., both in the engineering department and outside. Refers to H. A. Gray, F. E. Leland, A. B. MacMillan and L. C. Wason.

CORBETT, JOHN VINCENT, Dorchester, Mass. (Age 40, b. Boston, Mass.) Educated in the Boston Public Schools and English High. Since 1901 he has been employed by the City of Boston, Highway Division, as rodman, transitman and assistant engineer in the construction of streets. Refers to B. F. Bates, G. W. Dakin, C. S. Drake, A. E. Haskell, J. E. L. Monaghan, T. Parker and J. H. Sullivan.

NICHOLS, HALL, Watertown, Mass. (Age 27, b. Clifton, Mass.) Technical education. In the service July 30, 1918, to January 25, 1919. On his discharge he returned to Mass. Institute Technology as assistant in Course 1 for one term; then worked for the Aberthaw Construction Co. until January, 1920, as job engineer; very shortly after this he went to the Holyoke Water Power Co., where he spent about three months in design work and then took charge of construction of an addition to their power plant; he is now with the Aberthaw Construction Co. in the engineering department doing design work. Refers to H. J. Hughes, A. B. MacMillan, J. W. Rollins, C. M. Spofford and G. F. Swain.

SMITH, SYDNEY, Cliftondale, Mass. (Age 22, b. Schenectady, N. Y.) Graduate of Tufts College, 1922, with degree B. S. in civil engineering. Is now a structural draftsman in Office of Structures, Boston & Maine R. R. Refers to H. C. Archibald, B. W. Guppy, P. Jones and E. H. Rockwell.

STALBIRD, JAMES AVERY, Swampscott, Mass. (Age 21, b. Boston, Mass.) Graduate of Mass. Institute of Technology, 1922. Since July, 1922, he has been with the State Department of Public Health. Refers to H. E. Holmes, G. A. Sampson, C. M. Spofford, A. D. Weston and E. Wright.

SULESKY, ADAM EDWARD, Somerville, Mass. (Age 23, b. Clinton, Mass.) Graduate of Tufts College, 1922. July 6, 1922, to Dec. 1, 1922, was with the State Highway Commission as engineer's assistant; is at present in the Structural Department of the Boston & Maine R. R., as a structural draftsman. Refers to R. Abbott, H. C. Archibald, B. W. Guppy, P. Jones and H. H. O'Connor.

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 Chicago, Ill. Proposed New Constitution for Illinois. By
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Handbook for Electrical Engineers. Harold Pender. Gift
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DEVELOPMENT OF THE LIGHTER-THAN-AIR AIRSHIP.

BY EDWARD SCHILDHAUER.*

(Presented before The Affiliated Technical Societies of Boston, November 23, 1922.)

BEFORE the advent of aerial transportation the modes of travel were restricted by the extent of land and of water area. Railroad systems and shipping lines, alike, must terminate at the seaboard, where transfer may be made from one to the other. The airship, on the contrary, since it takes as its pathway the air, has no such limitations. It may establish its port in an inland city, should the facilities there seem superior to those on the coast, or in a seaboard town, which is usually preferable. It is of advantage that the port be made a combination of airship and airplane harbor, for it is the belief of those who have studied aerial navigation that the time will soon come when the lighter-than-air and the heavier-than-air craft will together afford the principal means of high-class transportation. The port should be located as closely as possible to the business center and be easily accessible to surface transportation, as is the case at McCook Field, Dayton, Ohio, which is within eight minutes of the center of activities.

From a study of probable future developments in airship transportation in America it appears that Chicago is the most favorable location for a main harbor, not only in view of present transportation facilities, but also from the standpoint of na-

* Consulting Engineer, American Investigation Corporation, Washington, D. C.

tional defense. While Chicago has made a start toward the establishment of an airport, like other cities, she is finding it difficult to impress upon the public the great benefits to be derived by the nation first to enter the field of development of aerial transportation, and similarly that those cities favorably located for aerial ports, if they will take early advantage of such a development are certain to benefit largely. In spite of some disadvantages, it is quite within the realm of possibility that Boston should become the preëminent airport in America, if the project is carried through in a comprehensive manner.

Whereas theoretically the route of an airship between two cities may be a straight line, economically the most direct route may not always be the most advantageous. For instance the shortest route between Chicago and London would pass over the southern portion of Labrador and a few degrees south of Greenland — a total distance of about 3 800 miles. By making a detour of but 180 miles the profitable ports of New York and Boston could be included. Similarly, in going west from Chicago, the shortest routing to Tokyo would pass over the central portion of Alaska, thence to Kamchatka and from there follow the group of islands to Tokyo — a distance of about 6 000 miles; whereas if the route were extended but 180 miles it would take in Seattle. From Chicago to Moscow the shortest route would be approximately 4 800 miles, passing over the northern part of Labrador, the central portion of Greenland and Norway, over Petrograd and thence southeast to Moscow. Stefanson, the explorer, assures us that airship routes crossing the arctic circle are perfectly feasible.

Of course, all of these routings must be varied slightly from season to season and from day to day, subject to the direction and the speed of the air currents.

European airship development has progressed, within the last decade from a very crude beginning, through a series of improvements, to an accomplishment whereby passengers may be transported safely over long distances and according to a predetermined schedule. It is a fact that of the thousands of passengers transported in passenger airships in Europe, not a single casualty has occurred.

Airships may be constructed on the principle of non-rigid, semi-rigid and rigid. The so-called "Blimp" is a non-rigid device and commonly has a cubature of about 5 000 cubic meters. With the semi-rigid airship there is a practical limit in size of about 30 000 cubic meters, though the Parseval has attained 31 000. This type is provided with a metallic girder to which the fabric of the hull is attached above, while below the gondola or nacelle is suspended. The Italians have had a certain amount of success with the semi-rigid ship and sold to the United States Government, at a time when the rate of exchange was favorable to us, one of a cubature of about 34 000 cubic meters. This airship was wrecked, killing some of the ablest airship personnel of our Army.

For practical purposes it may be considered that the total lift of an airship is equivalent to one thousand kilograms or one metric ton per one thousand cubic meters. Therefore the "Blimp" above mentioned, would have a total lift of about five tons.

DEVELOPMENT IN GERMANY.

In 1897 an airship was constructed of which the fabric covering was replaced by metal reinforced to make the structure rigid. It was inflated but did not perform a successful trip. Meanwhile Count Zeppelin was experimenting with rigid airships and in 1900 he brought out his first type — a very crude affair as compared with the airship of today. This was a long cylindrical ship with rounded ends, equipped with 32 h.p. motors. Maneuvering in the vertical direction was accomplished by manipulating a weight suspended from a slack line fastened to the front and rear of the ship, so that the center of gravity of the airship was altered, thereby inclining the ship either up or down as desired.

In 1905 the third airship was constructed another long cylindrical affair with the keel covered and vertical rudders.

During the following years various ships were designed and experimented upon, until in 1908 one was constructed which attained a duration flight of 20 hours. This ship was similar to the 1905 type, but had more extensive rudders. It was

forced to land owing to motor trouble and while the motors were being repaired a severe storm arose, the ship was torn from its mooring and wrecked. From that time until 1913 the ships constructed all had external keels and side propellers driven through the shafts from the nacelle swung from beneath the keel.

The LZ-18, or L2, of the Navy, however, by order of the Navy Department, was equipped with the interior keel and gangway, the room in this keel being utilized for the storage of fuel, ballast, goods, etc. On a trial trip with members of the Department on board, the ship burned and the entire personnel lost their lives. It was the practice of the Zeppelin Company to discharge the hydrogen into the hull structure, as a consequence of which there would be a mixture of hydrogen and air. In other words, the gas bags full of hydrogen (which in itself is non-explosive) were surrounded with an explosive mixture of hydrogen and air which condition obtained until the mixture had percolated through the hull fabric. The wreck was attributed to the fact that the airship was fully inflated when on the ground and as it rose the gas expanded, due to decrease in pressure of the atmosphere, and the automatic valves opened to discharge the hydrogen. The ascent was so rapid that the explosive mixture between the hull fabric and the gas bags could not dissipate fast enough through the fabric of the outer hull and therefore sought the manhole openings between the power plant and the interior gangway, thus coming into contact with the engine exhaust, which resulted in the explosion. This wreck occurred in November, 1913. On account of it the Zeppelin Company reverted to the exterior keel construction. In 1915, however, they again returned to the interior gangway and keel and have followed this construction to the present time.

The first Zeppelin airships were made of aluminum profiles, but after 1915 duraluminum was employed extensively. In the early airships, also, the outer fabric was wound circumferentially, whereas in later designs the fabric is laid on horizontally and tied to each other over the horizontal girders, the covering strap being placed over the tie string. This change has resulted in reduced resistance of the ship and thereby a gain in speed.

In the fall of 1908, as the financial resources of the Zeppelins were at an end, the German people donated a total of about six million marks, which amount was used for further experiments and is the foundation for the present Zeppelin activities. Shortly after this fund became available ships were built for commercial purposes.

The twelfth ship designed for the Navy was of 31 900 cubic meters, with operating nacelle in the rear, equipped with engine capacity to drive one propeller direct, and two side propellers driven by means of the typical early Zeppelin drive-shaft. In this form the box type of rudder gave place to plane surface rudders and stabilizers.

In the development of 1916 (the L-30) the commander's nacelle is again extended and the power plant is immediately annexed. The rear nacelle is as in the type just described, but in addition there are two power nacelles amidship, with direct driven propellers. The outline of this airship approached a stream-line. There were in all ten of this type of ship built.

In 1917 the L-40 was built, also with a cubature of 55 000 cubic meters. Sixteen ships of this type were constructed.

The next development was the disappearance of the side drive shafts from the rear nacelle. A ship of this type came to grief in France, on its return trip from England, and was studied and dissected by the French.

Another ship originally of 55 000 cubature, but which had been increased to 68 500 cubic meters by the insertion of thirty meters amidship, is the L-57, which was especially constructed for the South African trip. It had to be abandoned for this use, however, for on the trial trip an inexperienced pilot made a heavy landing, seriously injuring it. Within two weeks the second ship, L-59, which was part of the program, was finished and finally made the trip from Jambol, Bulgaria, across the Mediterranean Sea and Egypt, to a point west of Khartum, where it received word that the German garrison had surrendered, and was ordered home. The total lapse of time was a little over 95 hours and the total distance covered about 4 500 miles. Previously a ship of much smaller dimensions had been on patrol duty over the Baltic Sea for a period of 104 hours.

The airship of today is divided into from 13 to 19 gas compartments, at the end of each of which there is a main ring stiffened by diagonal wires. In order to strengthen the longitudinal girders which extend the whole length of the ship two intermediate rings are inserted, which are not reinforced by diagonal wires. Wires are also strung between the horizontal girders, forming the net which retains the gas bag in its proper position. Through them and through the girders the lifting power of the gas is transmitted to the hull.

The most recent development in passenger airships has been made in Germany in the "Bodensee", which made her initial trip on August 24, 1919, and her last trip in Germany on December 1, 1919, for in 1921 she was delivered to Italy and at the same time a sister ship to France. The "Bodensee" has three power nacelles, a central propeller driven by two 260 h.p. engines, and side cars with one engine each of 260 h.p., giving a total horse power of 1 040. This means a speed of 80 miles an hour for a ship of 22 500 cubic meters and a total lift of 22.5 tons, of which 45 per cent. is useful or disposable lift. As a ship is increased in size the disposable lift increases more rapidly than the total lift. Therefore it may be said that the efficiency of a ship increases as the size increases. The "Bodensee" accommodates about 24 passengers and has transported between Berlin and Friedrichshafen 2 380 passengers in a total operating time of 101 days. It has demonstrated that it is practicable for a ship carrying only about 20 or 24 persons to maintain a predetermined schedule. Whether an airship is designed to carry 20 or 100 passengers, however, the general outline remains the same, the only difference being in the cubature and the possible addition of power nacelles. The recent ships are very roomy and are equipped with wireless so that they may be in communication with predetermined stations at all times, receiving weather reports, news items, etc.

In the years 1908 to 1911 there was a competitor of the Zeppelin Company, in the person of Dr. Schuette, Professor of Naval Architecture and an engineer for the North-German Lloyd. Through his efforts the Schuette-Lanz Company was formed.

Calculations and experiments showed that ply-wood was stronger per unit of weight, than aluminum. All of the Schuette-Lanz ships therefore were made of ply-wood. The first ship constructed had serpentine girders which when assembled appeared as a series of helices. The depressions in the surface of the hull fabric interfered greatly with the speed of the ship and consequently this type was abandoned. In later types strips of cotton fabric are secured to the horizontal girders by twine and strips are glued to the fabric, to cover the twine, thus presenting a smooth surface to the action of the air. This early ship, above mentioned, had suspended nacelles with direct-driven three-wing metal propellers, a stabilizer in the front of the ship, another beneath the hull just back of the propeller, and plane surface stabilizers and steering vanes.

After several trial trips the ship was remodeled by the removal of the small front and rear stabilizers and the installation of full cross stabilizers at the tail, together with plane surface rudders. The power units were relocated to give better balance. This ship made many successful trial trips but had to come down in an open field on account of engine trouble, and while the repairs were being made a storm tore up the anchorage and the ship was wrecked.

The second ship produced by the Schuette-Lanz Company, in 1912 14, had an inside keel and gangway, direct drive of the propellers from the power units, gas shafts for the elimination of hydrogen gas (between each pair of gas bags, extending through the top of the hull) and horizontal girders instead of serpentine. It also had a central wire running from stem to stern in the center of the rings. This wire served the purpose of holding the center of the diagonal wires from the main rings, so that the gas pressure, should the ballonet be empty, would be everted against the network of only one-half the diameter, thereby decreasing the strain on the particular main rings affected. The rings were fabricated in a horizontal or flat position. In order to raise them to the vertical a triangular false work was employed. The main ring is secured to the triangle at three points and all the strains of handling are transmitted through this triangular frame.

All airships of the rigid type are equipped with water ballast contained in bags suspended from the keel. The discharge of this ballast is controlled from the commander's nacelle. Some of the forward and aft ballast bags are equipped with emergency trip so that the contents of the bag, about one ton of water, may be released instantly.

The power units are suspended by means of wire ropes and struts. These struts, however, are inferior in strength to the member to which they are fastened to the hull, so that in case of heavy landing, they will break instead of injuring the airship structure.

The characteristics of the second airship produced by the Schuette-Lanz Company, above described, have remained through the twenty ships produced by them, with the exception that whereas the second ship had a cubature of about 19 000 cubic meters the last has 56 000 cubic meters.

The Zeppelin Company has put out a total of 115 ships, 88 of which were built during the war period, 25 before the war, and 2 since. The Schuette-Lanz Company delivered a total of 16 ships to the German Government, two of them before the war. The principal difference between the ships of the two companies at the present time is that the Schuette-Lanz Company adheres to the idea of having the commander's nacelle separate from the power units, while in the Zeppelins the commander's nacelle and power unit are combined. The Schuette-Lanz arrangements were adopted, however, by the Zeppelin Company in 1919, in the construction of the "Bodensee," in which the commander's quarters are in the forward part of the nacelle for passengers, and the 3 power units are suspended aft. The developments of the two rigid airship companies of Germany have now merged, and it requires an expert on detail to distinguish the Zeppelin from the Schuette-Lanz ship.

BRITISH DEVELOPMENT.

The British method of erecting an airship is different from the German in that they build the rings in a horizontal position and attach thereto a portion of the horizontal girders in a vertical position. The structure is then handled by means of block

and falls, with a slip noose, so that it can be transferred from a vertical to a horizontal position.

Rigid airship design and construction was started in Great Britain about 1909, and the first ship underwent so many changes and "improvements" that after it was filled with gas and launched in May, 1911, the "May-fly," as it was popularly called, did not fly — it was too heavy. This, however, did not deter them from continuing the development with ultimate success. In 1917 a ship of Class 23 was launched — a cylindrical affair with pointed ends and external keel, following the lines of the early Zeppelin, the power units being suspended beneath the keel and the propellers direct-driven. The three propellers were in line and consequently in each other's slip stream. A fighting airplane was successfully carried and released from this ship, though no successful return to the airship was reported.

In December, 1916, the German airship L-33 was shot down at Colchester, England, which showed stream line construction and suspended nacelles of the Schuette-Lanz type. From this and later captures the airship known as R-33 and R-34 was evolved. Also the British have adopted the Zeppelin method of combining the forward power units with the commander's nacelle. The balonnets are at present made either of silk or cotton fabric, covered with gold-beater's skin.

It was in the R-34 type that the Trans-Atlantic trip of 1919 was made, reaching Mineola, Long Island, after 108 hours in the air. The return trip was made in 75 hours.

AERIAL DEVELOPMENT IN AMERICA.

For American conditions a larger capacity of ship will be necessary, such as one of 150 000 cubic meters, which would be capable of carrying 100 passengers and 80 tons of express matter from Boston to Chicago overnight. In order to put America first in the air, the night-flying should be done by airships and the schedule so arranged that the landing will be early in the morning. In fact, were it not for the night-flying capabilities of the airships, they might not be able to compete with railroad and airplane transportation, but the maneuvering of an airship

at night is not as nerve-racking as by day where it must pass through alternate spaces of sun and cloud. Safe night-flying by airplanes has not yet been achieved, but it has been successfully accomplished by the airship. From the same field airplanes may take individual passengers or small groups of passengers to the outlying cities within a radius of 200 to 250 miles,

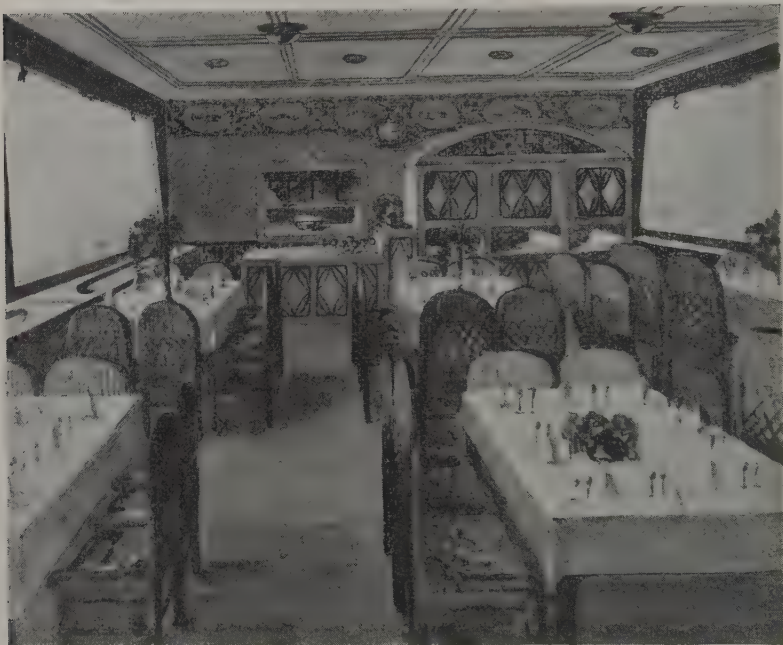
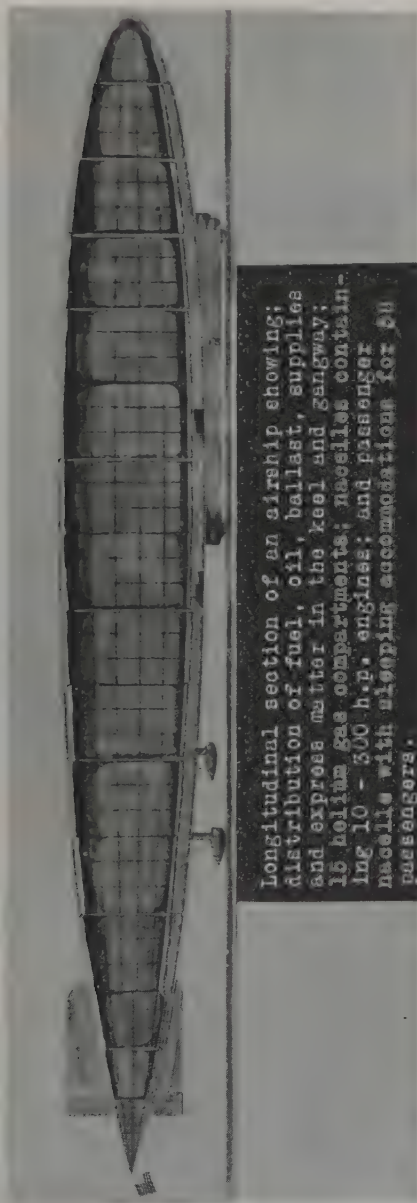


FIG. 1—DESIGN FOR A DINING-SALOON FOR A 100 PASSENGER AIRSHIP.

reaching their destination during the daylight hours, and also may carry high-class express matter and mail, leaving to the airships the longer passenger lines which would mean night travel.

The equipment of a modern up-to-date airship approaches in luxury that of a first-class ocean liner. The illustration, Fig. 1, shows a draftsman's conception of the dining-saloon of 100 passenger airship capable of making trips to South America. The ship would have a capacity of 200 000 cubic meters, a length



Longitudinal section of an airship showing:
 distribution of fuel, oil, ballast, supplies
 and express matter in the keel and gangway;
 15 helium gas compartments; nacelles contain-
 ing 10 - 300 h.p. engines; and passenger
 nacelle with sleeping accommodations for 50
 passengers.

FIG. 2.

of 975 ft. and a total horse power of 5 400. This would admit of a promenade deck 225 ft. long, sleeping accommodations as luxurious as those in the most elaborately equipped ocean liner, dining room, salon, etc. The hangar necessary for such a ship

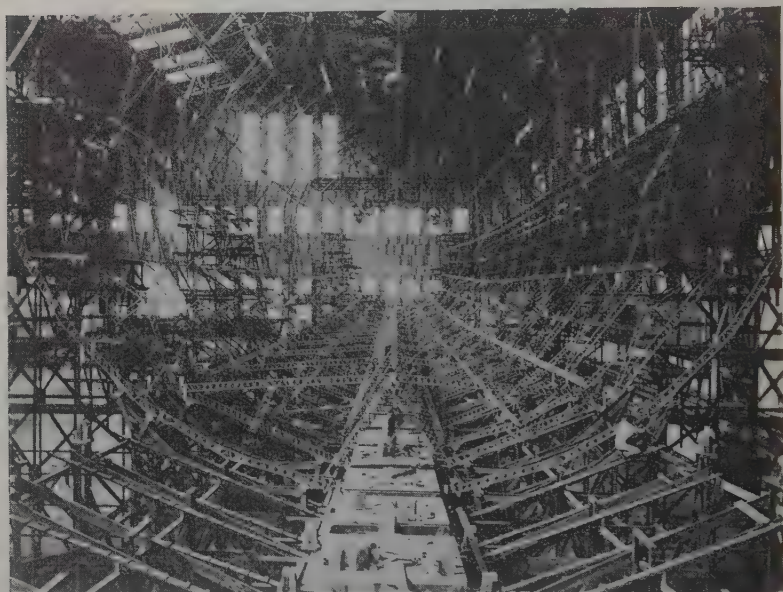


FIG. 3 — ASSEMBLY OF AIRSHIP ZRI AT THE U. S. NAVAL AIR STATION, LAKEHURST, N. J.

(Official Photograph U. S. Navy.)

would be approximately 160 ft. wide, 1 050 ft. long and 160 ft. high. Figs. 2, 3 and 4 illustrate some of the construction details of an airship.

THE AIRPORT.

As already mentioned, it is of advantage to have the airport as near as possible to the center of activities and readily accessible to other transportation lines, so that transfer of passengers and express matter may be facilitated. The total area of such a port should be at least 100 acres, although the necessary landing field with mooring mast, hangars, and gasometers

will probably not occupy the whole of this land. The 100 acres should nevertheless be kept under the control of the airship authorities, even though the greater portion of it be utilized for the cultivation of cereals, or in some such way. Scott Field at Belleville, Ill., not far from St. Louis, is an excellent example of an airship harbor, and is the center of activities for the lighter-than-air branch of the Army Air Service. The hangar here

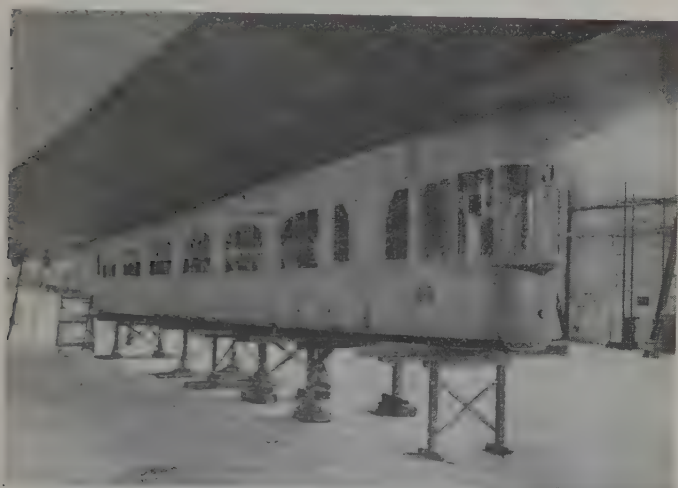


FIG. 4 — TYPICAL AIRSHIP NACELLE FOR 24 PASSENGERS, COMMANDER, NAVIGATORS AND WIRELESS OPERATOR.

is 800 ft. long, 150 ft. wide and 150 ft. high, in inside dimensions. The largest hangar in the world is at Lakehurst, N. J., and was designed in our Navy Department. At this field, also, is the mooring mast shown in Fig. 5. When a ship wishes to land at this mast it maneuvers to about five or six hundred feet from the ground and then drops a mooring line from the nose of the ship. This is coupled to the line which is strung through the center of the mooring tower and through the center of the mooring cone, and is laid on the ground to leeward. After these lines are secured the airship is permitted to rise to equilibrium where the commander trims the ship, making it a little

nose-light. Then, on signal from the commander the winches are started, the ship is hauled into the mast and when it touches, the cone is locked, the total time required for these operations varies from 10 to 15 minutes. After this the gas, oil and water lines are attached to the airship and whatever it is necessary



FIG. 5—AIRSHIP MOORING MAST AT U. S. NAVAL AIR
STATION, LAKEHURST, N. J.

(Official Photograph U. S. Navy.)

to take on board is moved in this way. While the ship is at the mast only a few officers and men are necessary to maintain proper equilibrium. The mast shown has the most up-to-date equipment, including mast elevator so that passengers and airship personnel can make the journey of 150 or 160 ft. to and from the ground without climbing. To release the airship it is only necessary to weigh it off properly and withdraw a bolt which opens the cone holding the ship in position.

Boston is well situated for an eastern terminus, as the manufacturing towns of high-grade articles are within easy reach by means of airplanes. As a national center, however, Boston or any of the Atlantic coast cities are not as well situated as the metropolis of the middle west, Chicago. Therefore, in order that Boston may reap the benefits of aerial transportation it should start at the earliest possible moment to lay out a harbor on a comprehensive scale, and induce aircraft companies to utilize the field, so that aerial transportation will be established in the early stages before competitive inducements are offered by other coastal cities. In the consideration of an airport it is necessary that weight be given not only to its accessibility, but also to its availability for all three classes of aerial transportation — seaplanes, airplanes and airships, in order that it may afford a combined or “Union” port. With these requirements in mind the development on the harbor front in Boston appears to offer a splendid location for an airport.

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COMMERCIAL USE OF AIRPLANES.

BY EDWARD P. WARNER.*

(Presented before The Affiliated Technical Societies of Boston, November 23, 1922.)

THE lighter- and the heavier-than- air craft both have their uses in commercial transport, but those uses lie in different spheres. Mr. Schildhauer has set forth the position of the airship, which is peculiarly fitted for journeys over long distances at relatively moderate speeds, moderate at least as compared with the maximum attained by the airplane. The other type, the airplane, is particularly designed and suited for transport over much shorter distances at very much higher speeds.

Commercial aerial transport as we understand it today dates from August 26, 1919, when the London to Paris route was opened. To be sure, there had been various attempts to carry passengers and freight before, but these projects had been small in extent and had lasted relatively for short periods and they were not operated on a basis which we can now consider as truly commercial.

I shall not weary you by undertaking to sketch the history of the development of the airplane through the three years before the opening of the London-Paris route and up to the present time. The development has been too great, too extensive and continuous for me to attempt even to give the briefest outline

* Associate Professor of Aeronautical Engineering, Massachusetts Institute of Technology.

in the whole time allotted for my talk tonight. I want to turn then at once to the present position of aerial transport in Europe and America and to speak briefly of some of the problems which those who are seeking to use the airplane for commercial purposes have had to meet.



FIG. 1 — AIR LINES OF EUROPE.

(Fig. 1). This map shows the air lines of Europe, as they are now, and it will be observed that there is reasonably direct connection between most of the European capitals. For example, one line runs direct from Paris to Constantinople, with stops at the Central Europe capitals. You can go by airplane from Paris to Constantinople in $2\frac{1}{2}$ days, whereas it takes 4 days by express train. There are a great many lines in Germany, and there is a line operated by German capitalists in coöperation with the Soviet Government, from Königsberg to Moscow. That is the most interesting line in Europe in some respects.

The journey is done by train in five days and nights from Berlin to Moscow. The air journey from Königsberg to Moscow is done in 12 hours. A night train from Berlin to Königsberg makes the total time from Berlin to Moscow 24 hours. The line is very extensively patronized by diplomats and Soviet officials.

As another illustration as to what can be done in the saving of time I will cite an experience of my own. On August 4 last I had breakfast in Vienna, left the hotel at 7.30 A.M., and took an airplane for Paris. With two changes of plane and pilot, at Prague and Strasbourg, we reached Paris at 8.30 that night, in 8 hours and 47 minutes actual flying time. By fast express the time from Vienna to Paris is 32 hours — giving a saving of about 65 per cent. by air.

That gives a very slight idea of the present status of air transport in Europe. There are scheduled for service in France next summer air routes covering nearly 7 000 miles a day. In Germany there are about 2 400 miles of regular daily passenger services.

Although I am on the program to speak on European Commercial Aviation I should not feel I had done justice to the subject — to the commercial use of the airplane — if I did not touch on commercial flying in the United States. We are, I think, in this country under the impression — spread by magazine articles — that the Europeans are far ahead of us in the commercial development of the use of the airplane. That is true to a certain extent. They have developed it in a way in which we have not developed it here. For example, there is only one passenger air line in the United States at the present time — or rather one in summer and one in winter, operated by the same company. There is, however, notwithstanding the sparsity of passenger development, more actual commercial flying in the United States, measured by airplane miles, than in any single country in Europe. During the past year the total distance covered in France by commercial lines was approximately 1 300 000 miles. The total distance flown by the United States Air Mail in the regular pursuance of its work, carrying mail every day both ways between New York and San Francisco, was 1 800 000 miles, and they flew their route with 96 per cent. perfect per-

formance through several months—a performance of over 90 per cent. over the whole year. They met all kinds of obstacles—terrible weather conditions, machines getting caked with ice, ice accumulating on the propeller, and the pilots sometimes having to fly only 15 or 20 ft. above the railroad tracks to find their way. Nevertheless they have kept going without a single fatality for over a year. I think we are prone to be too pessimistic with regard to commercial aviation in this country, and do not realize the extent of the work already being done here.

If we turn from the present status of flying to the restrictions laid upon it and to the conditions under which it works, we find the problems to be confronted can be divided into three classes—legal, economic and technical. With regard to the legal questions I shall say nothing. It is a very complex subject and I have not time to take it up now. To the two other classes, however, I will devote some attention. It might perhaps be better to pay particular regard to the technical questions before this audience, but the economic problems are absolutely fundamental. Airplanes may be operated under conditions of inefficiency, improper conditions as regards equipment, even dangerous conditions, but no private concern will continue to operate a line on which it is losing money. So we come to the question—how much does it cost to run an airplane? That is the first thing to be settled, but the answer cannot be given in a few words. It depends upon the type of airplane and the conditions under which it is operated. As a round figure, however, we may say the cost of operation with present day machines will be from 12 to 15 cents a passenger-mile, with airplanes of the type now available, assuming they are carrying a full load. Allowing 15 cents a passenger-mile, and allowing the usual amount of baggage, bringing the total weight to 200 lb. per passenger—would bring the cost to \$1.50 a ton-mile, which works out at about 50 cents a pound for express between New York and Chicago. On this 50 cent per pound express rate several companies are now basing plans for airplane lines between New York and Chicago. The unit cost of operation can in general be decreased by the use of large planes,

but of course the companies cannot afford to put on the large planes until they are assured sufficient load to warrant them. They have to start with small planes and with a high unit cost until the public has shown a willingness to patronize the line sufficiently to warrant the use of large planes. I think, however, that with the development we can foresee in the next few years and with that increase in public patronage which we hope will come after the lines have been operating for a while we may confidently expect a reduction in the operating cost to about 80 cents per ton-mile. The present cost per air-mile by Air Mail, which has kept exact figures, is a little over \$1 per airplane-mile including all overhead. The ton-mile rate is very unfair for comparison there, because the Air Mail machines, originally taken over from the Army, do not carry anywhere near the pay load that should be carried with their engines. The body is not big enough to store it. With the same engine, with re-design of the cargo space, it ought to be possible to carry nearly three times the pay load now carried and, with modified wings to carry a pay load of about 1 600 lb. — which allowing \$1.10 an airplane-mile would work out about \$1.50 per ton-mile.

Having gained some idea as to costs of operation to the operating company the next question that logically arises has to do with the present charges for air transport. There are a lot of lines running in Europe, several which have been going for more than three years and have increased their service. For example, the line from Toulouse to Casablanca and Rabat has been running an airplane every day except Sunday over a 2 000-mile route during the past year, having started three years ago with three airplanes a week. Evidently there is some economic incentive to continue the service. Present passenger fares on air lines in Europe — not counting Germany and the other Central European states because theirs is a peculiar problem — runs from 8 to 13 cents a passenger-mile. The maximum is about the figure I set for the cost of operation, and the minimum is considerably below that. The cost of the cross-channel service, on which a great many Americans have travelled, is 13 cents a passenger-mile. That will probably

be reduced next summer. From London to Paris or Amsterdam, when I was there the rate was 6 guineas — roughly \$28. During the past month the London-Amsterdam rate was reduced to 4 pounds, or \$17.50 — from 13 cents to about 8 cents a passenger-mile. Eight cents a passenger-mile is the uniform rate in France.

In Germany conditions are different, no less so in connection with air transport than in every other particular. I haven't the latest figures on the cost of air transport in Germany, but when I was there last July one could go by air from Berlin to Hamburg for \$3.50 — a little less than 2 cents a passenger-mile. That is typical of the fares all over Germany.

You will note that there is a considerable hiatus between what I have given as the fares and what I have given as the operating costs. As to the method by which that hiatus is at present filled, I will postpone discussion for a moment, because before we can realize the full extent of the gap, the extent to which it has to be dealt with, we have to know something of the amount of travel on the air lines, the amount of business they are doing.

Fifteen cents a passenger-mile to operate and 13 cents a passenger-mile as the fare, doesn't mean much. It may be more profitable, in fact it was found so on the London-Paris route, to run at 13 cents than to run at 25 cents, because it was easier to get passengers and cutting the fare in half more than doubled the traffic. During the past two summers the planes on that route have been very well filled. If you want to know the record in respect to traffic, to show the very best of what has been done, it is to the London-Paris line that you must turn first of all, because, for various reasons, that line has outpaced all others as regards the business done. I have brought with me the exact figures for a short period last summer, during the last three weeks of August and the first of September, for travel between London and the continent on the London-Paris and London-Amsterdam routes. In that time they had 2 390 passengers, that is, 85 passengers a day. They have about 20 machines running regularly each day, ten each way, and they are mostly pretty well filled. There are some other lines

not doing so well, however. On some of the continental lines the percentage of business done to the available cargo space is very low. On one in particular the average cargo has been about half a passenger and 5 lb. express. Frequently the machine has been absolutely empty. I might cite my own experience in this connection. Flying from London to Paris in an eight-passenger machine every seat except one was filled. From Paris to London in a ten-passenger machine every seat was filled. From Paris to Brussels, in a 12-passenger machine, there was only one other passenger. From Prague to Paris in a six-passenger machine I was the only passenger, and the only other cargo was a little sack of mail weighing ten pounds.

Obviously there is a choice between routes, and the choice depends on the principles which must always govern the usefulness and popularity of an air route. Those principles are partly technical and, at present, partly political, but mostly economic. You must have a route over which the weather conditions are fairly uniform and where there is a considerable traffic made up of people in a great hurry or those who are the owners of goods which they are in a hurry to deliver. Such routes might be easy enough to find, but unfortunately there is another condition — the route must not be well served by the existing means of transportation. For example, the route between Boston and New York is already quite adequately served, and an air service would be impracticable as long as the New York airport is as at present, an hour from the city. The time by airplane would be about $2\frac{1}{2}$ hours from field to field, but the total time would be $3\frac{1}{2}$ hours at present. The perfection of the London-Paris route for aerial exploration results from the fact that the present means of transport are very slow and uncomfortable and a good many people are glad to avoid trans-shipment of themselves and their goods at the two sides of the Channel. It is rather amusing that a large amount of the express matter sent is perishable, being shipped by air, because the owners do not dare trust it to the express companies. Among the first shipments sent on this London-Paris route were several boxes of eggs.

When I say that the present means of transportation should be insufficient you have to look for the causes which may result

in their insufficiency. Those causes are found most commonly in natural obstacles, such as the English Channel or mountain ranges, and particularly canyons and depressions, which offer no obstacle at all to the airplane. In the case of Europe another severe travel barrier is found in the international boundaries, as all who have been there since the war can testify. Over there they have a jolly habit of turning you out at 3 o'clock in the morning to have your baggage examined. Every time you go across a boundary that proceeding is repeated, often on both sides of the boundary, but an airplane can pass right over a country without interference so long as it doesn't land. Also travelers by air receive very lenient treatment, the airports providing about one customs officer per passenger.

Another question which comes up in the choice of routes for air travel is whether travel is to be by night or by day. Here in this country competition with night trains must always be considered. For instance we should have to compete with the night train from Boston to Chicago, which covers the distance in 22 hours—14 of them during the night. The airplane does it in 8, but must at present do it by day. It is probable that development of airplane lines will occur first in America in connection with the carrying of express, because the planes are not now prepared to carry people by air at night, but express can be flown at night with reasonable regularity. Night flying is now being regularly carried out by the Army. By introducing night operation, the air mail can be carried from coast to coast in 28 hours.

Another condition in picking a route is that we shall have good weather, and particularly absence of fog, to maintain the regularity of service. In that respect the London-Paris route is rather poor, interruption by weather conditions being frequent.

The success of the London-Paris line is particularly interesting to us because it gives an indication of the interest Americans are taking in air transport. If abroad, why not here? During the past summer the statistics of nationalities traveling between London and Paris show 50 per cent. American tourists. On that route, the Americans are furnishing fully half the business, and I hope we shall have a chance to

patronize lines in this country instead of going to Europe in the near future.

I said several moments ago I would leave for the time being, the matter of the gap between the cost of operating airplanes and the fares charged for riding in them. The gap is closed by the subsidies which exist in most European countries.

I want to dispel a few popular illusions regarding subsidies. There seems to be a general belief in this country that all air lines are subsidized and they could not operate otherwise. That is not true. There is at least one European line now operating without direct assistance between Lymgne, on the English coast, and Ostend. There is another which has been running with a sort of negative subsidy — that is, the Government undertakes to make up one-third of the company's losses. If the company wins they don't get anything. This company operates running between London and Amsterdam. It has maintained regular daily service throughout the past year, and the total amount paid by the Government in subsidies was less than \$9 000. Subsidies are, however, very liberal in some countries. In France they amounted to 23 000 000 francs two years ago, and 41 000 000 last year, and from latest information will probably come to 45 500 000 francs this year. Those figures are rather misleading, however, because the layout of the French lines takes into account imperial and colonial interests, and there is no real economic justification for some of them in the amount of traffic which they can attract.

To return again to America — there seems to be a common idea here that there is a strong propaganda for subsidizing in this country. Personally, I have never heard of any such agitation. Some of us have studied the matter, but no subsidy bill has ever been brought before Congress or has been put up for adoption. In the long run I think subsidies will prove harmful in some cases. A bad subsidy is worse than none. Consider the position France once took with respect to shipping subsidies. Under one subsidy law sailing vessels collected more than steamships. The result was that France was going from steam to sailing craft when all the rest of the world was making progress toward steam, and her operating firms were finding sailing more

profitable simply because they could collect a big subsidy. At the present time it is practicable to operate airplanes at a profit in some countries without carrying any cargo at all. This is a bad condition. Commercial aviation should be able to stand on its own feet soon.

Considering now the technical problems, I will present first a few pictures of the types of airplanes used in Europe on



FIG. 2. — A. D. H. 34 BIPLANE.

The type used by two of the companies operating on the London-Paris line. Equipped with a 450-h.p. engine, it carries eight passengers inside the cabin.

the air lines, including some in which I rode myself this summer. (Figs. 2 to 5.)

It has sometimes been the tendency of airplane designers to pay too much attention to efficiency, the amount of load per horse power, and too little to the point of view of the passengers — too little to the comfort of the machine. They have decorated the cabins elaborately, to be sure, but it is also very important to keep the cabins well ventilated and the seating arrangements comfortable, and most of all to obviate the noise, which is a serious objection. Great progress is now being made. Bad ventilation has practically disappeared, and the noise is very



FIG. 3. — PASSENGERS DISEMBARKING AT LONDON AFTER A CROSS-CHANNEL FLIGHT IN A HANDLEY PAGE.

The Handley Page biplane is twin-engined, carries radio and an operator, and is one of the largest types in regular service at the present time.



FIG. 4. — ANOTHER TWIN-ENGINED BIPLANE.

The Farman Goliath in which the writer flew from Paris to Brussels. Twelve passengers are accommodated in the two cabins.

much less marked than it was at first. It is now possible for passengers to converse with one another, without raising their voices to an uncomfortable degree. The planes are still pretty noisy, but much better than they were.

Before taking up the arrangement of airports I should like to say something about the operation of the airplanes themselves. The things we seek in operating are first, economy;



FIG. 5. — A FOKKER MONOPLANE.

In service between Brussels and Amsterdam, as well as on the Königsberg-Moscow and other lines. The Fokker is among the lowest-powered commercial machines, having a single engine of 260 h.p.

second, safety — and we have gone a long way in that respect; and third, reliability. I want to go into safety statistics in detail for a moment.

The K. L. M. is a Dutch line running practically without subsidy and has flown in the past two years about 700 000 miles and never had a serious accident. The London-Paris lines this summer carried roughly 6 000 passengers and had but two accidents. One was a collision in the air and the other a very mysterious accident, the exact cause of which is still unknown. There was about one fatality out of every 2 000 persons carried.

Safety is largely a matter of operating experience and of careful attention to detail. Bad weather, of course, also comes into it; being overtaken by storms or fog; failures of the engine, causing forced landings and other unfavorable conditions, but the accidents are never due to failure of the airplane as such. The fault lies now in most cases rather with those operating than with those designing, and the number of fatalities is being largely reduced as more experience in operating is being gained.

As for reliability, that is again rather a question of maintenance than of design. You have heard from time to time of commercial airplanes, so-called. Views of some of them have been shown. The difference between these and the other planes lies chiefly in the size and the interior arrangement of the fuselage. There is nothing remarkable in the design of a commercial craft. What is most required is untiring attention to detail in maintenance, and if we get that we get reliability and safety. I want to emphasize that we can expect continual improvement in these particulars.

I want to cite specifically the record of one company during the past year. One company was operating a line between London and Paris. They owned three airplanes but had the misfortune early in the season to have two of those planes, while being driven across the field to tank up with fuel, run into each other and both had to go to the factory for repairs. This left them with but one machine. For one month they ran a service of two trips a day each way with the one airplane. They covered about 20 000 miles in that one month with that plane. After every 100 hours of flying they would change the engine overnight and start the next morning with a fresh engine. They kept the machine going all summer at nearly that same clip. Careful examination of the machine after it had had about 1 000 hours in the air, showed that it was then in nearly the same condition as when it left the factory. During about 1 500 hours of flight to date there had not been one forced landing due to engine trouble.

I shall pass over the question of navigation in order to get to that of landing fields. That is a question of particular interest at the present time because Boston is now laying out

an airport which is going to put us in the very forefront in this country as regards aerial facilities.

Once again I can best make my points through pictures with liberal captions, showing the equipment of some of the European airports.

Just a word about the application of this to the United States. You have seen in a general way what the present



FIG. 6. — THE SPAD IN WHICH THE WRITER TRAVELED FROM PRAGUE TO STRASBOURG.

The Spad is remarkable for its high speed, which is about 120 miles per hour, far above the average of commercial airplanes.

situation is in the United States. At the present time we have in America no air craft regulations except such as have been provided by a few of the states. In America there is no governmental encouragement of any sort for commercial flying. There have been no actual steps towards laying out airways for civil use, no attempt to do anything for commercial aviation. At the present time there is a bill before Congress — it is in the House now — to provide for a Bureau of Aeronautics to do some of these things.

This is the country of Wilbur and Orville Wright, and the airplane is largely a product of American genius. It seems



FIG. 7. — A FOUR-SEATER POTEZ BIPLANE.

One minute after a forced landing in a Czecho-Slovakian wheat field.



FIG. 8. — THE LANDING STAGE AT CROYDON, AND THE PASSENGERS
LEAVING A GOLIATH.

Showing the lighthouse in the background. Light is thrown upwards directly, and also down on to the white base of characteristic form. This white target serves as an identifying mark for the field.

to me the time is ripe for America to adopt a firm and consistent air policy for the first time. We have had many courses of action, more or less wise, but we have never yet, as a nation, had an air policy. To summarize what I think such a policy should contain:

First. The passage of a bill for aircraft regulation and the establishment of a Bureau of Aeronautics;

Second. The laying out of a system of airways, useful alike in war and in peace;



FIG. 9. — THE OFFICES AND WAITING-ROOMS OF THE VARIOUS AIR TRANSPORT COMPANIES AT CROYDON, THE LONDON TERMINAL AIRPORT.

Third. Ratification of the National Air Navigation Convention, to put us in line with the rest of the world;

Fourth. The adoption of a measure whereby the Air Mail can be carried by private firms under contract with the Government. At present it is carried only by the Government directly. There is a bill now before Congress providing for the Post Office Department letting contracts to private companies to carry mail by air.

This I feel is the minimum action we must take before America can take her proper position in the field of commercial flying.



FIG. 10. — THE CROYDON TRAFFIC CHART.

Reports on the movements of machines in the air are received by radio and indicated on this board by moving little metal models of airplanes along a row of nails marking off the route. Models of different colors are used for machines of the different companies.

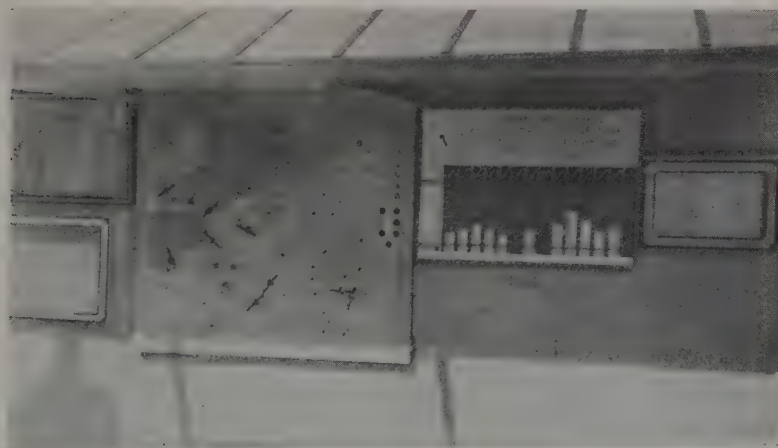


FIG. 11. — THE WEATHER BOARD AT LE BOURGET, THE PARIS AIRPORT.

The heights of the white strips on the board at the right indicate the heights of the lowest clouds at various points along the routes to be flown. Weather reports are received hourly by radio.

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PAPERS AND DISCUSSIONS

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BOSTON AIRPORT.

BY R. C. MOFFAT.*

(Presented before The Affiliated Technical Societies of Boston, November 23, 1922.)

I WILL tell you briefly what we are going to have very shortly in Boston in the new airport, and something about how we came to get it.

Shortly after the war a lot of returned pilots in the Aero Club of Massachusetts, and Army officers at headquarters of the various divisions, interested in flying, started an agitation to try to get a landing field at Boston. This resulted in research work being done by one of the City engineers, who examined all possible locations, except the one finally adopted, which has since then been reclaimed from the harbor. It came down to about six locations which appeared possible, and the estimated cost of construction varied from \$50 000 to \$250 000 or more to put the fields in condition to be used as landing fields and so nothing very much was done until the fall of 1921. Then the Post Office Committee of the Chamber of Commerce trying to get the Air Mail Service extended to Boston, took up the matter of a landing field at Boston. They saw no chance of getting the Air Mail Service extended here without a field. They got authority from the Chamber of Commerce to take up the matter from all angles, and coöperated with the Army and Aero Clubs and found that a landing field was wanted here for several purposes — for the

* 1st Lt. Air Service, U. S. A.

Air Mail, individual owners, commercial and military flying. The Regular Army detachment at Framingham has a field, but that field is 20 miles from our office and is very inconveniently situated. Also a field is needed for the use of the National Guard now in the South Armory in Boston. They have no airplanes and will not have until there is a place to house them. So a bill was introduced in January, 1922, by which it was proposed that the State set aside land for the field and prepare it so planes could land on it, and that the Federal Government should put up the hangars.

The location of this field is on made land in East Boston, reclaimed from the harbor by hydraulic fill. The area is being extended all the time. The field will only cover a small proportion of this area, but will consist of two runways and a site for the hangars. The whole plot cost the State a couple of million dollars to construct. It was done for commercial purposes, and eventually will be used for factories, dock sites, etc. But at present Boston has there more ground than she can use. This land would otherwise lie idle, so the State has agreed to lease it to the Federal Government for ten years at a rental of \$1 a year, provided the Government put up the hangars and allow the field to be used by the Air Mail and individuals or by anyone who will comply with the regulations of the officers in charge of the field.

The sketch of the field (Fig. 1) shows its general arrangement. The runway is 1 500 ft. long by 100 ft. wide and there is another one of the same length, forming a Tee. It will be surfaced with cinders for 100 ft. in width and smoothed and rolled for 50 ft. more on each side, making a total width of 200 ft. and a length of 1 500 ft. Building at the land end has been restricted so that no building can be more than 10 per cent. in height of its distance from the field, so the planes will have a clear approach to the runway and a clear takeoff from the field. As it is now there are no buildings for approximately half a mile in one direction and in the other three directions it is all water, so the field is ideal so far as the approach is concerned. The ground is level and the field is adjacent to deep water so that it is available for sea planes and land planes, both. The present plan is for two

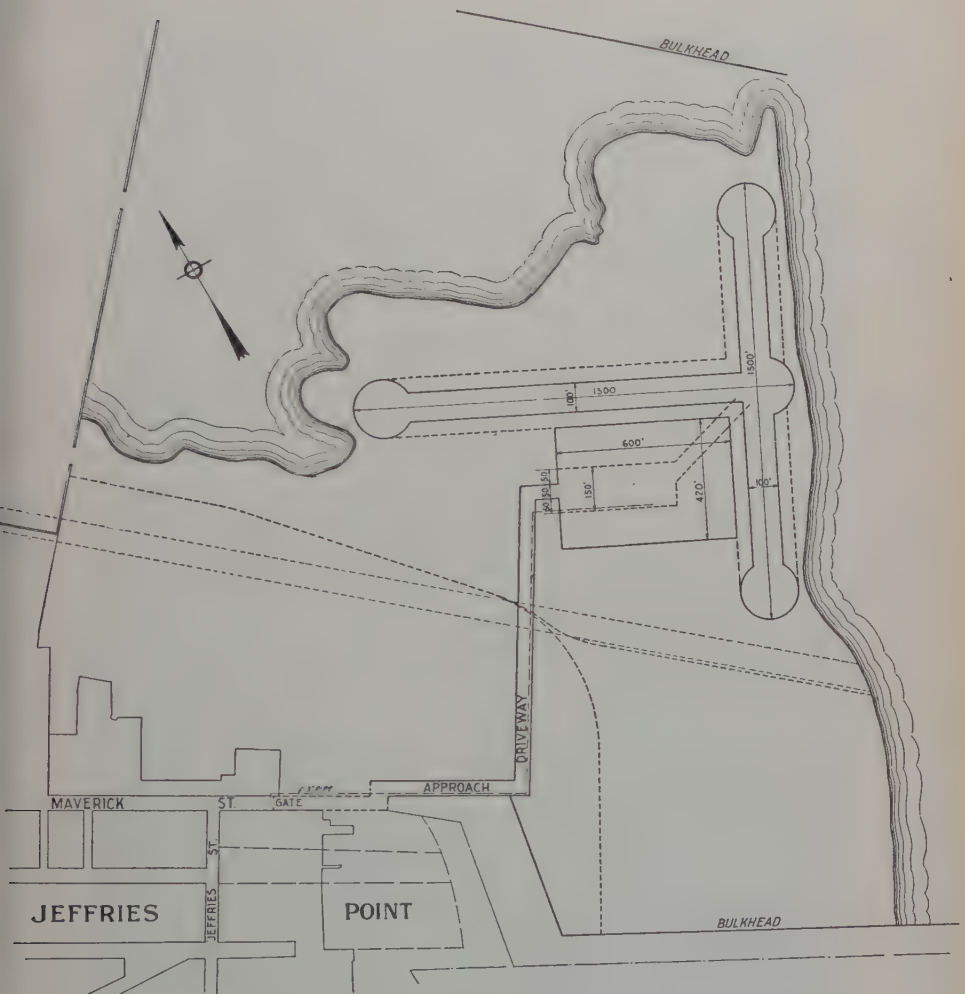


FIG. 1 — AEROPLANE LANDING AND APPROACHES, EAST BOSTON, MASS.

Regular Army hangars for training reserve officers, etc., and two hangars for the National Guard; and also there is land along these runways which may be leased to individuals and commercial companies.

The road to the field is now all graded and it has cinders for a portion of its length. The two hangars are nearly completed. They will have a concrete floor and steel frame and will be metal covered buildings. They should be very good buildings for the purpose. The photograph taken from the air (Fig. 2) shows the location and the present stage of construction of the hangars. The field will be available to all planes and will be ample for some time to come. The Tee is placed so that no matter which way the wind is the plane can land approximately into the wind.

The contract for building the hangars has been let to various contractors and it is planned to lease the property next them for more hangars.

The story of how this field was finally put over is so complicated that I can't tell it entirely. I will just briefly touch on it. When the bill was introduced this land was in charge of the Committee on Public Lands and Harbors, so the bill was submitted to them. This committee first voted to hold it over to the next session. This action would have killed the bill. Finally it was decided that the committee should hold another hearing and it was decided that it should pass. As that committee had no money it was sent to the Committee on Ways and Means and it was decided to appropriate \$35 000 to construct this field. If the expense should run over this amount it was decided that the balance must be raised from other sources. So the Chamber of Commerce agreed to see that the money was forthcoming should it be needed, and the bill finally passed in May, 1922. The contracts were let and signed on the very last possible day. The lease was signed June 28, sent by special delivery to Washington and signed on June 30 and was gotten over just in the nick of time. It was soon found, however, that \$13 000 more would be needed and the Chamber started the fifth of July to raise \$13 000 or \$14 000 which they must have by August 15 or the hangars would not be built as the bids lapsed on that date. They got it and \$1 700 to spare. There



FIG. 2 — HANGARS, EAST BOSTON LANDING FIELD.

are \$3 800 also being held for some special purpose. I should like to call attention to the fact that over 500 individuals subscribed to this fund, and a good many people who subscribed were in no direct way interested in aviation. They were neither fliers nor interested in commercial aviation. They just thought it would be a good thing for Boston.

The runways are partly graded but the cinder surfacing has not been commenced. The field will not be ready to land on before next spring. Two of the hangars will be completed within a month and the other two within two months. They are on the way now to Boston and will probably take about four weeks to erect.

MEMOIR OF DECEASED MEMBER.

WILL B. HOWE.*

MR. WILL B. HOWE, City Engineer of Concord, N. H., since March 21, 1883, passed from an active and exceedingly efficient life April 1, 1922.

He was born in Concord, July 3, 1859, the son of William Holman and Mary (Carleton) Howe, both of old Revolutionary stock. He was a direct descendant of Joseph Howe who fought in the French and Indian War and was also a Minute Man at Lexington. The old Howe Tavern at Sudbury, Mass., immortalized by Longfellow as "The Wayside Inn" was built by an ancestor and occupied by three generations of Howes.

Mr. Howe graduated from Concord High School in 1876, beginning his life work in 1878 as rodman with Mr. Charles C. Lund, C. E. of Concord, principally on railroad work, including the construction of the Profile and Franconia Notch Railroad and location of the Bethlehem Branch.

After Mr. Lund's demise in 1880, Mr. Howe continued with his successors, Foss and Merrill, on location and maintenance on the B. C. & M. Railroad, the Concord Railroad and branches, and in general engineering work which included the Sewalls Falls power development in Concord.

In September, 1883, Mr. Howe went to Nova Scotia as principal Assistant Engineer on what is now known as the Central Railway with headquarters at Bridgewater, N. S., later becoming acting Chief Engineer until May, 1888, when he returned to Concord and assumed the management of the office of Foss and Merrill and so continued until March, 1893, when he was chosen Concord's first City Engineer, which position he retained until his demise.

Of his long and faithful service in Concord many monuments remain: his assessors' plans, methodically indexed: a wall

* Memoir prepared by Fred W. Lang and William H. G. Mann.

map of Concord City and environments: sewer and steel bridge structures put up under his careful and accurate supervision.

He was affiliated with many societies and lodges, among which may be mentioned the American Society for Municipal Improvements, the New Hampshire Good Roads Association, the National Geographic Society, member of the Boston Society of Civil Engineers since March, 1896, member Blazing Star Lodge, Trinity Chapter, Horace Chase Council, Mount Horeb Commandery, Bektash Temple A. A. O. N. M. S., New Hampshire Society of Veteran Free Masons, and was vice-president of the Council of the Order of High Priesthood. He was also a member of the New Hampshire Historical Society, the Men's Club of the South Congregational Church, the Wonolancet Club, the Concord Gun Club, and of the New Hampshire Society, Sons of the American Revolution, serving as secretary and treasurer the past two years.

In Nova Scotia, on January 22, 1889, Mr. Howe married Ida May Starratt, daughter of James Starratt, Jr., and Elizabeth Waterman, his wife. A daughter, Myrna, prominent as a war nurse in France is their only child.

Efficiency, economy, and a particularly good sense, were Mr. Howe's attributes as an engineer. As a man it is an honor to have been his friend and assistant.

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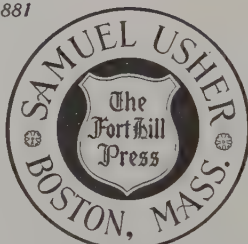
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